

WHAT IS CLAIMED IS:

1. In a press for forming a product from a blank of material disposed between a punch assembly and a die assembly, an improved knockout comprising:
 - a shaft having opposed ends slidably supported in one of the punch and die assemblies for selective axial movement between an extended position and a retracted position;
 - a plate fixed to a first end of the shaft and disposed to support the blank during movement of the shaft from extended to retracted positions and to knock the product out of the one of the punch and die assemblies during movement of the shaft from retracted to extended positions; and
 - a tapered portion fixed to a second end of the shaft and disposed in the extended position to symmetrically engage a tapered recess in the one of the punch and die assemblies that slidably supports the shaft.
2. The press of claim 1, wherein the one of the punch and die assemblies supporting the shaft comprises a bushing defining a lumen for slidably receiving the shaft and having the tapered recess at one end thereof.
3. The press of claim 1, wherein the shaft is square.
4. The press of claim 3, wherein the one of the punch and die assemblies supporting the shaft comprises a bushing defining a square lumen having the tapered recess in one end thereof.
5. The press of claim 1, wherein the shaft is round.

6. The press of claim 5, wherein the one of the punch and die assemblies supporting the shaft comprises a bushing defining a round lumen having the tapered recess in one end thereof.
7. The press of claim 1, wherein the shaft is triangular.
8. The press of claim 7, wherein the one of the punch and die assemblies supporting the shaft comprises a bushing defining a triangular lumen having the tapered recess in one end thereof.
9. The press of claim 1, wherein the tapered portion and the tapered recess have complimentary cone-shapes.
10. The press of claim 1, wherein the tapered portion and the tapered recess have complimentary obelisk-shapes.
11. The press of claim 1, wherein the tapered portion and the tapered recess have complimentary pyramid-shapes.
12. A tooling system in a press for forming a product from a blank of material disposed between a punch assembly and a die assembly, comprising:
 - a knockout further comprising a shaft having opposed ends, a plate fixed to one opposed end, and a tapered portion; and
 - a bushing supported by one of the punch and die assemblies and defining a lumen configured to slidably receive the shaft for axial movement between an extended position and a retracted position, the lumen having a tapered receiving section at one end thereof configured to mate with the tapered portion of the knockout when the shaft is in the extended position.
13. The tooling system of claim 12, wherein the shaft is square.

14. The tooling system of claim 13, wherein the bushing further defines a square lumen.
15. The tooling system of claim 12, wherein the shaft is round.
16. The tooling system of claim 15, wherein the bushing further defines a round lumen.
17. The tooling system of claim 12, wherein the shaft is triangular.
18. The tooling system of claim 17, wherein the bushing further defines a triangular lumen.
19. The tooling system of claim 12, wherein the tapered portion and the tapered receiving section have complimentary cone-shapes.
20. The tooling system of claim 12, wherein the tapered portion and the tapered receiving section have complimentary obelisk-shapes.
21. The tooling system of claim 12, wherein the tapered portion and the tapered receiving section have complimentary pyramid-shapes.
22. A die assembly in a press for forming a product from a blank of material, comprising:
 - a knockout further comprising an elongated shaft having opposed ends, a plate fixed to one end and a tapered portion fixed to the other end; and
 - a bushing supported by the die assembly and defining a lumen configured to slidably receive the shaft for axial movement between an extended position and a retracted position, the lumen having a tapered receiving section at one end thereof configured to mate with the tapered portion of the knockout when the shaft is in the extended position.

23. A punch assembly in a press for forming a product from a blank of material, comprising:

a knockout further comprising an elongated shaft having opposed ends, a plate fixed to one end and a tapered portion fixed to the other end; and

a bushing supported by the punch assembly and defining a lumen configured to slidably receive the shaft for axial movement between an extended position and a retracted position, the lumen having a tapered receiving section at one end thereof configured to mate with the tapered portion of the knockout when the shaft is in the extended position.

24. A tooling system comprising:

a punch assembly having a first plate; and

a die assembly having a second plate opposing the first plate, wherein at least one of the punch assembly and the die assembly further comprises:

a knockout having an elongated shaft with opposing ends, one of the first plate and the second plate fixed to one end of the shaft, and a tapered portion fixed to the other end of the shaft; and

a bushing defining a lumen configured to slidably receive the shaft, the lumen having a tapered receiving section configured to mate with the tapered portion of the knockout.

25. The tooling system of claim 24, wherein the die assembly and the punch assembly are disposed in a press for forming a product from a blank of material disposed between the punch and die assemblies.

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26. The tooling system of claim 24, wherein the tapered portion of the knockout mates with the tapered receiving section of the lumen when the shaft is in a fully extended position.

27. A knockout for a press having a punch assembly and a die assembly disposed in opposed selective mating relation for forming a product from a blank, the die assembly including a plate for receiving the blank and ejecting the product, the knockout comprising:

a shaft having opposed first and second ends, the first end being adapted to carry the plate of the die assembly; and

a tapered portion fixed to the second end of the shaft and disposed for mating in a complementary recess in the die assembly when the shaft is moved to eject the product.

28. The knockout of claim 27, wherein the shaft is square.

29. The knockout of claim 27, wherein the shaft is round.

30. The knockout of claim 27, wherein the shaft is triangular.

31. The knockout of claim 27, wherein the tapered portion is cone-shaped.

32. The knockout of claim 27, wherein the tapered portion is obelisk-shaped.

33. The knockout of claim 27, wherein the tapered portion is pyramid-shaped.

34. A bushing for a press having a punch assembly and a die assembly disposed in opposed selective mating relation to selectively form a blank into a product and including a knockout shaft having a tapered end and disposed to eject the product from the press with an opposing end by slidable movement to an extended position, the bushing being fixable to the die assembly and comprising:

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a lumen for slidably supporting the knockout; and
a tapered recess for receiving the complementary tapered end of the
knockout shaft.

35. The bushing of claim 34, wherein the shaft receiver is square.
36. The bushing of claim 34, wherein the shaft receiver is round.
37. The bushing of claim 34, wherein the shaft receiver is triangular.
38. The bushing of claim 34, wherein the tapered recess is cone-shaped.
39. The bushing of claim 34, wherein the tapered recess is obelisk-shaped.
40. The bushing of claim 34, wherein the tapered recess is pyramid-shaped.
41. In a press for forming a product from a blank of material disposed between a punch assembly and a die assembly, a method of operating an improved knockout comprising:

slidably supporting a shaft having opposed ends in a lumen defined by a
bushing configured in one of the punch and die assemblies;

selectively moving the shaft axially between an extended position and a
retracted position;

supporting the blank with a plate fixed to a first end of the shaft during
movement of the shaft from the extended position to the retracted position;

knocking out the product from the die assembly during movement of the shaft
from the retracted position to the extended position; and

symmetrically engaging a tapered portion fixed to a second end of the shaft
with a tapered recess in the bushing when the shaft is in the extended position.